

REMARKS

Claims 1-9 and 11-54 will be pending upon entry of the present amendment. Claims 1, 2, 8, 9, 11-16, 18, 23, 24, 28, 31, 34, and 35 have been amended, and claim 10 is herein canceled. New claims 37-54 are herewith submitted.

The Examiner has rejected claims 1-36 under 35 U.S.C. § 102(b) as being anticipated by Hetzler (5,227,625).

Prior to addressing the rejections of the claims, the applicants wish to review some aspects of the present invention. Referring first to the background portion of the specification, a hard disk drive is described, and in particular, the read/write components, including the E-block, voice coil motor, suspensions, gimbals, and sliders (which incorporate the read/write heads). Recording of pilot traces on the hard drives, according to known methods, is described. The description continues at line 9 of page 3 to describe the introduction of a second order of positioning of the heads, stating:

Recently, however, to obtain more precise and finer control of the position of the slides 16 with respect to the corresponding hard disks 2, it has been proposed to use a moving device with dual actuation stage, in which a first rougher actuation stage including the voice coil motor 24 which moves the assembly formed by the E-block 8, the suspensions 12, the gimbals 14 and the sliders 16 across the hard disks 2 during the track coarse search, while a second finer actuation stage includes a plurality of integrated microactuators 30 (one of which is shown in Figure 3) each arranged between a corresponding slider 16 and a corresponding gimbal 14 and having the aim of carrying out a finer regulation of the position of the sliders 16 during the tracking.

...

The introduction of a degree of freedom of movement between each slider 16 and the corresponding suspension 12 resulting from the introduction of a microactuator 30 means that, in order to be able to carry out the aforementioned initial operation of writing the control information in the pilot traces, **...it is necessary to know, not only the position of the suspensions 12 with respect to the corresponding hard disks 2, but also the position of the sliders 16 with respect to the corresponding suspensions 12.** (emphasis added)

~~The Background section continues, at line 6 of page 4, stating,~~

In practice, however, ...[the previously proposed positioning method] is difficult to put into practice, as the precision of determination of the position of the

slider...has proven to be insufficient for...writing the control information in the pilot traces....

For its part, Hetzler is directed to a device configured to “provide a system for measuring the angular position of a pivoting body, such as a rotary actuator arm...” (column 1, line 67-column 2, line 1). Hetzler stresses the advantages of its device for use in determining the position of the actuator arm of a recording disk file, and describes in considerable detail the physics related to selection of a grating to be placed on the actuator arm, and from which a beam of light is to be reflected (see, for example, column 4, lines 5-59). In describing the use of its method, with respect to the positioning of a rotary actuator arm, Hetzler teaches the positioning of the grating on the actuator arm itself, offering no teaching to position the grating elsewhere (see, for example, Figures 6 and 7, column 2, lines 51 and 52, column 4, line 59, column 5, lines 35 and 36 and column 7, lines 30-34,). Hetzler also teaches the manufacture of the grating using various materials, such as thin polyester films, compact disk-like material, or photographic film, which is then to be attached to the rotary actuator arm (see column 6, lines 20-36, emphasis added).

It is also important to note that the methods taught by Hetzler “may be used to measure the angular position of any body pivoting about a fixed point in space” (column 2, lines 43-45).

Embodiments of the present application are directed to methods and systems that are configured to cooperate with hard drives in which the read/write heads are movably coupled to the E-blocks of the drives, such that merely determining the angle or position of the E-block is inadequate to determine the position of the various read/write heads.

It will be recognized that a read/write head that is movably coupled to an E-block, which is, in turn, configured to pivot around an axis, cannot be described as a body that pivots around a fixed point in space. If the movement of the read/write head, relative to the E-block, is rotational, then its movement is a complex rotation around one fixed, and one non-fixed point, while if the movement of the read/write head relative to the E-block includes non-rotational movement, then the overall movement of the read/write head is even more complex. Thus, correctly positioning of the read/write head over the hard drive requires not only that the

precise angle of the E-block be known, but that the position of each read/write head relative to the E-block must also be known.

An embodiment of the present invention provides a method not only for determining the position of the E-block but also for determining the position of each of the read/write heads on the E-block. In addition, according to an embodiment of the invention, the optical grating of the present invention is formed directly on the structure to be measured, rather than applied thereto, as taught by Hetzler.

Amended claim 1 recites, in part,

a supporting body configured to be affixed to a microactuator so as to be movable with respect to an E-block of the hard disk drive;... and

an optically detectable structure coupled to the supporting body and structured to cooperate with optical measurement means to determine a position of the read/write head relative to the E-block.

Hetzler fails to teach at least these limitations of claim 1. Hetzler is silent with respect to a supporting body of a read/write head configured to be movable with respect to an E-block of a hard drive, and also with respect to a structure configured to determine a position of the read/write head relative to the E-block. In contrast, Hetzler, insofar as it is directed to a hard disk drive, teaches only a device for measuring the angular position of a rotary actuator arm (see column 2, lines 26-28 and 51-53, column 4, lines 59-64, column 7, lines 30-33, and column 8, lines 27-33). Hetzler also fails to teach an optically detectable structure coupled to the recited supporting body, teaching, instead, positioning a grating on the rotary actuator arm. Accordingly, Hetzler fails to teach all the limitations of claim 1, which is allowable thereover. Dependent claims 2-8 are also allowable with independent claim 1.

While claim 7 is allowable as a dependent claim of an allowable base claim, applicants believe claim 7 is also allowable on its own merits. Claim 7 recites, "wherein said optically detectable structure is integral with said supporting body."

As previously described, Hetzler teaches the manufacture of individual gratings consisting of thin polyester films, compact disk-like material, or photographic film, which are then applied to the rotary actuator arm of a data recording disk file. Accordingly, Hetzler fails to anticipate the limitation of claim 7, which is thus allowable thereover.

Applicants believe claim 8 is also allowable on its own merits, apart from its allowability as a dependent claim of an allowable base claim. Claim 8 recites, in part,

at least one microactuator, said supporting body presenting a generally parallelepipedal shape with a bottom face turned towards said hard disk, an upper face coupled to said microactuator, and four side faces, wherein said optically detectable structure is arranged on one of said side faces of said supporting body.

Hetzler fails to teach these limitations, offering no teaching as to the use or employment of a microactuator associated with a read/write transducer, and further, teaches the positioning of an optical grating on the rotary actuator arm of a data recording disk file, thus teaching away from placing an optically detectable structure, instead, on a supporting body of the read/write transducer. Accordingly, Hetzler fails to anticipate or teach the limitations of claim 8, which is allowable thereover.

Claim 9 recites, in part,

providing a supporting body configured to be applied to a microactuator coupled to an E-block of the hard disk drive; ... and

providing, on the supporting body, an optically detectable structure....

Hetzler is silent with respect to the composition of the data head, and so fails to teach the provision of a support body configured to be applied to a microactuator, and further fails to teach the provision of an optically detectable structure on such a support body. Accordingly, claim 9 is allowable over Hetzler, together with dependent claims 11-17.

Dependent claim 11 is allowable on its own merits, as follows:

Claim 11 recites, "forming the optically detectable structure on one of said side faces of said supporting body." Hetzler fails to teach the formation of an optically detectable structure on the supporting body, teaching instead the formation of an optical grating to be later applied at a desired location. Additionally, Hetzler fails to teach the positioning of such a structure on the side of a supporting body configured to support and position a read/write transducer, but rather teaches the positioning of an optical grating on the side of a rotary actuator arm. Accordingly, claim 11 is allowable over Hetzler.

Dependent claims 12-15 each recite various kinds of optically detectable structures formed on the supporting body, and thus each is allowable over Hetzler on its own

merits, since Hetzler teaches the separate manufacture of the grating, followed by its application to the rotary actuator. In addition, claims 16 and 17 each recite steps for the formation of an optical grating on the supporting body. Hetzler offers no teaching to provide such methods in the formation of an optical grating, or its formation on the supporting body. Accordingly, these claims are each allowable on their own merits.

Claim 18 recites, *inter alia*,

means for supporting and moving said read/write transducer relative to the E-block; and

an optically detectable structure carried by either said read/write transducer or said supporting and moving means and configured to cooperate with optical measurement means.

While claim 18 varies in scope from other claims previously discussed, claim 18 is allowable over Hetzler for many of the reasons presented in support of the allowability of previous claims. Dependent claims 19-22 and 39 are also allowable together with base claim 18.

Claim 20 recites said optically detectable structure being carried by said read/write transducer. Claim 21 recites said optically detectable structure being integral with said read/write transducer. Claim 22 recites said read/write transducer comprising a supporting body and a read/write head, said optically detectable structure being carried by said supporting body. Claim 23 recites that said supporting body has "...an upper face coupled to said supporting and moving means, and...wherein said optically detectable structure is arranged on one of said side faces of said supporting body."

Hetzler fails to teach the limitations of any of claims 20-23, as has been demonstrated, either with reference to previous claims, or in the previous comparison of Hetzler with various aspects of the invention. Accordingly, each of these claims is allowable on its own merits.

Claim 24 recites, in part,

an optically detectable structure carried by either said read/write transducer or said supporting and positioning means; and

optical measurement means cooperating with said optically detectable structure for measuring the position of said read/write transducer relative to an E-block of said hard disk drive.

Hetzler fails to teach at least these limitations of claim 24. With respect to the positioning of an optically detectable structure, Hetzler teaches such positioning only to the rotary actuator arm. With respect to the optical measurement means, Hetzler teaches only various means for measuring a position of the rotary actuator arm, with respect to the measurement means or the rotary actuator disk file (see, for example, column 2, lines 53-55, column 4, lines 59-64, and column 8, lines 58-60). Hetzler offers no teaching with respect to the location or measurement of the position of a read/write transducer relative to an E-block. Accordingly, claim 24 is allowable over Hetzler. Dependent claims 25-30 are also, therefore, allowable.

Claim 28 is allowable over Hetzler on its own merits, apart from its dependence on an allowable base claim. It is well known in the art that the E-block of a typical hard disk drive is configured to carry a plurality of read/write heads, numbering from 2 to 10, or more. Claim 28 recites

a plurality of hard disks, wherein the supporting and positioning means is one of a plurality of means for supporting and positioning respective read/write transducers, wherein the optically detectable structure is one of a plurality of optically detectable structures, each carried by either one of said respective read/write transducers or one of said supporting and positioning means, and wherein the optical measuring system further comprises means for moving said second end of said optical guide means for placing it at one of said plurality of optically detectable structures.

Because Hetzler does not contemplate the need to locate individual read/write heads with respect to the E-block, Hetzler further does not contemplate the need for a plurality of optically detectable structures, and additionally is silent with respect to moving an optical guide means to positions corresponding to various ones of a plurality of detectable structures. Accordingly, claim 28 is allowable over Hetzler.

While claim 31 differs in scope from previously argued claims, the Examiner will recognize that many of the arguments presented in support of these previous claims may also be applied in support of claim 31. In particular, claim 31 recites "a structure configured to move the transducer with respect to an E-block of the hard disk drive;...and means...for interpreting the position of the transducer relative to the hard disk drive.

The methods taught Hetzler are inadequate to locate a transducer with respect to a hard drive, where the transducer is subject to motion not constrained by a single point of rotation. In the case of the structure of the device of claim 31, an E-block is known to rotate around a first point, while the transducer is also movable with respect to the E-block. Thus, merely determining the angle of the E-block is not sufficient. Accordingly, Hetzler fails to teach at least these limitations of claim 31, which is thus allowable thereover.

Dependent claims 32-34 are also allowable with base claim 31.

The text of amended claim 35 is presented herebelow:

35. A method, comprising:
directing a light beam at an optically detectable structure coupled with a read/write transducer of the hard disk drive;
detecting light reflected from the optically detectable structure; and
determining the position of the transducer, relative to a suspension of the read/write transducer, by analysis of characteristics of the reflected light.

Hetzler fails to provide any teaching with respect to determining the position of a transducer, in general, or with determining the position of the transducer relative to a suspension of the transducer, and so, fails to teach all the limitations of claim 35. Claim 35, together with dependent claims 36-38, is allowable over the cited art.

Claim 38 recites directing an additional light beam at an additional optically detectable structure coupled with an additional read/write transducer of the hard disk drive, and determining the position of the additional transducer, relative to a respective suspension, by analysis of characteristics of light reflected from the additional optically detectable structure. Hetzler fails to teach the limitations of claim 38. Hetzler is silent with respect to any additional transducers associated with a hard disk drive, and does not contemplate measuring more than a single point with respect to such a hard drive. Accordingly, claim 38 is allowable over the cited art, on its own merits, apart from its dependence upon an allowable claim.

The limitations of claim 41 include first and second locating means, the first for locating a read/write head to a first, lower degree of accuracy, and the second for locating the read/write head to a second, higher degree of accuracy.

Hetzler fails to anticipate the limitations of claim 41, teaching only a single level of locating accuracy. Accordingly, claim 41 is allowable over Hetzler. Dependent claims 42-48 are also therefore allowable.

Claim 43 recites that "the second locating means are configured to be movable in a first axis parallel to a second axis defined by positions of a plurality of read/write heads coupled to the E-block."

As has previously been explained, Hetzler is silent with respect to pluralities of read/write heads, and so fails to anticipate all the limitations of claim 43, which is thus allowable thereover.

Claim 49 recites "an E-block configured to support a plurality of read/write heads...and a grating structure integrally formed the E-block...."

Hetzler teaches the formation of a grating structure on a film or foil, which is then applied to the rotary actuator arm, and so fails to teach the integral formation of a grating structure on the surface of the E-block. Accordingly, claim 49 is allowable over Hetzler, together with independent claims 50-52.

Claim 53 recites "a slider of a disk drive; and an optical grating formed as a unitary part of a body of the slider."

Again, Hetzler teaches the formation of a grating structure on a film or foil, which is then applied to the rotary actuator arm, and so fails to teach the limitations of claim 53, which is thus allowable thereover, together with dependent claim 54.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited. In the event the Examiner finds minor informalities that can be resolved by telephone conference, the Examiner is urged to contact applicants' undersigned representative at (206) 622-4900 in order to expeditiously resolve prosecution of this application.

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The Commissioner is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

Respectfully submitted,

SEED Intellectual Property Law Group PLLC



Harold H. Bennett II
Registration No. 52,404

HHB:wt

Enclosure:
Postcard

701 Fifth Avenue, Suite 6300
Seattle, Washington 98104-7092
Phone: (206) 622-4900
Fax: (206) 682-6031

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